PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Method of Making Thin Flat Electroded Ceramic Elements

We, ERIE RESISTOR CORPORATION, a Corporation of the State of Pennsylvania, United States of America, located at 644 West 12th Street, Erie, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of making thin flat electroded ceramic elements such as ceramic phonograph pick-ups.

Ceramic phonograph pick-ups of polarized barium titanate ceramic and the like require thin flat ceramic elements which typically have a length of 3/4-inch, a wide of 1/8-inch and a thickness of from 8 to 10 mils. Such elements have heretofore been made by cutting from fired ceramic sheets of the finished thickness (8 to 10 mils). Ceramic sheets of such extreme thinnesses are difficult to make to the required flatness.

This invention consists in a method of making thin flat ceramic elements having a width and length much greater than the thickness and electroded on opposite faces, but not on the edges, which comprises casting into a matrix of settable plastic a plurality of fired ceramic bars side by side but out of contact with each other, said bars having width and thickness corresponding respectively to the length and width of the ceramic elements, cutting flat wafers off the matrix of a thickness equal to the thickness of the ceramic elements by cuts transverse to the length and along the width and thickness directions of the ceramic bars embedded in the matrix, said wafers having flat surfaces flush with opposite faces of the ceramic elements embedded therein, coating both the plastic and ceramic portions of said opposite faces of the wafers with metal, and removing the metal coated ceramic elements from the wafers.

This invention is likewise intended to make the thin flat ceramic elements for phonograph pick-ups by cutting from fired ceramic sheets but instead of starting with sheets of from 8 to 10 mils thick, the sheets have a thickness equal to the width of the elements, e.g., 1/8-inch. The sheets also have a width equal to the length of the ceramic elements, e.g., 3/4-inch. Such thick ceramic sheets, which are in effect bars, are very easily made. The flat ceramic elements are made by cutting slices from 8 to 10 mils thick from the ends of the bars.

In the accompanying drawing:—

Fig. 1 is a perspective of a ceramic element for a phonograph pick-up;

Fig. 2 is a perspective of a ceramic bar for making the element of Fig. 1;

Fig. 3 is a view showing how the elements are sliced off the ends of the ceramic bars;

Fig. 4 is is perspective of one of the slices; and

Fig. 5 is a greatly enlarged end view of a sandwich type transducer made from two of the ceramic elements.

In Fig. 1 of the drawing is shown a ceramic phonograph pick-up element 1 which typically consists of a thin flat ceramic piece having, for example, a length of 3/4-inch, a width of 1/8-inch and a thickness of from 8 to 10 mils. As shown in the greatly enlarged cross sectional view in Fig. 5, the ceramic elements are used in pairs. Opposite faces of the ceramic elements are provided with metal electrode coatings 2 and 3 and adjacent electrode coatings 3 are soldered together to provide a sandwich construction used in the bender type pick-up. When the ceramic is barium titanate, a polarizing voltage is applied between the center electrode 3 and the outer electrode 2 activating the ceramic and making it piezo-electric. The output of the pick-up appears across the outer electrodes 2. Because of the sandwich construction, it is important that the ceramic

elements 1 be flat as otherwise the elements are likely to be broken while being fastened together. It is difficult to manufacture ceramic sheets of the required thinness and flatness. Although ceramic pick-up elements have been made for some time, the common method of manufacture is to cut the elements out of sheets having the thickness of the pick-up elements.

Instead of using thin ceramic sheets for making the ceramic elements, it is proposed to use relatively thick ceramic bars 4 having a width 5 equal to the length 5*a* of the ceramic elements and a thickness 6 equal to the width 6*a* of the ceramic elements. The ceramic bars 4 are very easy to make and are much easier to handle than sheets having the thickness of the pick-up elements.

In the manufacture of the ceramic pick-up elements, a plurality of ceramic bars 4 are arranged side by side out of contact with each other and cast in a matrix 7 of settable plastic. A suitable plastic is one of the solventless varnish type of casting resins which has the properties of wetting the ceramic such as one of the epoxy resins. These solventless varnish or casting type resins have the property of setting up by addendum polymerization without the evolution of gas. As soon as the plastic has set, the ceramic bars are firmly embedded in the plastic matrix.

In order to make the ceramic pick-up elements, a series of wafers 8 are cut off the ends of the matrix of plastic and ceramic bars, for example, by a diamond cut-off wheel 9. It will be noted that the cut through the matrix between the dotted lines 10 is substantially wider than the thickness of the wafer 8. In spite of the extreme thinness of the wafer 8 (8 to 10 mils) the cut is quite easily made because the ceramic bars are firmly supported in the plastic. It will be noted that the wafers are cut transverse to the length of the ceramic bars and along the width and thickness of the ceramic bars.

It will be noted that in the wafer 8, the ceramic elements 1 have opposite faces flush with the plastic 7 and have their edges embedded in the plastic. The elements 1 are also spaced apart. To apply the electrode coatings 2 and 3 to the ceramic elements, the entire opposite faces of the wafer 8 (both the plastic and ceramic portions) are coated with metal, for example, by coating with one of the silver ceramic paints. Upon firing, the silver paint is set to opposite faces of the ceramic elements 1 and the plastic 7 disintegrates. If the opposite surfaces of the wafer 8 are coated by other metal coating processes in which the plastic 7 is not disintegrated or burned away, the ceramic elements 1 with the metal coatings 2 and 3 thereon can be easily broken out of the plastic at the end of the metal coating operation.

What we claim is:—

1. A method of making thin flat ceramic elements having a width and length much greater than the thickness and electroded on opposite faces, but not on the edges, which comprises casting into a matrix of settable plastic a plurality of fired ceramic bars side by side but out of contact with each other, said bars having width and thickness corresponding respectively to the length and width of the ceramic elements, cutting flat wafers off the matrix of a thickness equal to the thickness of the ceramic elements by cuts transverse to the length and along the width and thickness directions of the ceramic bars embedded in the matric, said wafers having flat surfaces flush with opposite faces of the ceramic elements embedded therein, coating both the plastic and ceramic portions of said opposite faces of the wafers with metal, and removing the metal coated ceramic elements from the wafers.

2. A method as claimed in Claim 1 in which the metal is applied in the form of a metallic ceramic paint which is set up by firing the wafers at a temperature which disintegrates the plastic.

3. A method of making thin flat ceramic elements substantially as described.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

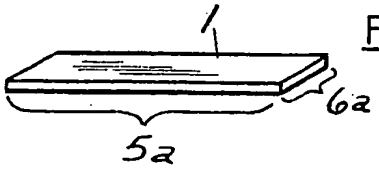

FIG. 1

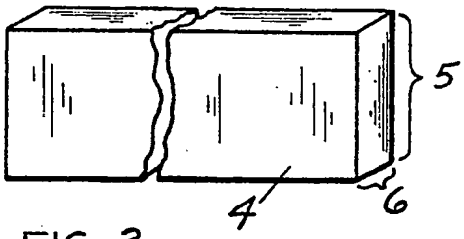

FIG. 2

FIG. 3

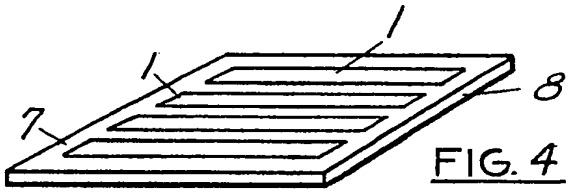

FIG. 4

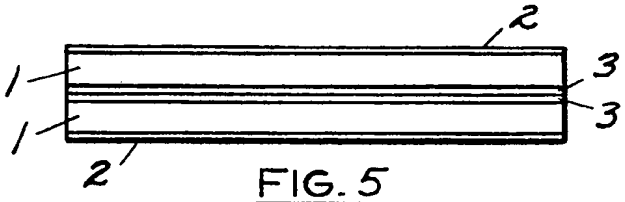

FIG. 5